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ABSTRACT

Communication prostheses are critical components of the nonvocal child's communication process, but are only one component. This article focuses on the steps involved in communicative interaction processes and the potential barriers to the development of effective interaction and analysis of nonvocal communicative interactions. A discussion of the processes involved in communicative interaction highlights the complexities created when the interaction includes a nonvocal person and emphasizes the more active role which may be required of the listener. Potential barriers to effective interaction include: (1) altered conversational patterns; (2) augmentative devices and techniques; (3) speed; (4) laborious and tiring formulation and expression of messages; (5) neglect of the speaker's repertoire of expressive modes; (6) effect of the symbol system used on conceptualization of experiences; and (7) general experience, skill level, and motivation to communicate and interact. A study involving three nonvocal severely physically handicapped children, aged 6-7, and their teachers in classroom interactions found that communicative interactions in all contexts were dominated by teachers and were usually teacher-initiated. These findings are contrasted with those documented in studies of communicative interactions of vocal children. Implications of the study for communication programs are discussed. (JDD)

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COMMUNICATIVE INTERACTION PROCESSES INVOLVING NON-VOCAL PHYSICALLY HANDICAPPED CHILDREN

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Communicative interaction processes involving nonvocal physically handicapped children

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HELPING NONVOCAL children learn to communicate with other persons is often a complex and frustrating task. Many nonvocal children experience severe physical handicaps, and, as a result, their ability to interact with, manipulate, or learn from their physical and social environments is limited. Fortunately, there have been many recent developments that can help these children become more active participants in their environments. An important development has been an attitudinal change on the part of speech/language pathologists. Instead of feeling that there is little they can do for nonvocal children, practitioners are now actively searching for methods that can most effectively *augment* the child's existing oral skills. This important attitudinal change has come about in part as the result of technological advancements in rehabilitation engineering. Engineering developments have produced a diverse array of aids and devices that can supplement the skills of handicapped children, providing

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them with the ability to manipulate, control, and become active participators in their environments. Of particular importance has been the development of communication prostheses. With the variety of types of communication prostheses that are presently available, handicapped children's physical limitations or barriers to communication can be alleviated. Communication prostheses have provided nonvocal children with a *mode of expression*, a channel through which to communicate.

Although communication prostheses are critical components of the nonvocal child's communication process, too often they are thought of as panaceas (e.g., If one is trying to develop *communication skills* in a child, perhaps a communication prosthesis is the answer). Once a prosthesis has been provided, it is often expected that a child will use it as his/her "voice," and will immediately develop effective social interaction skill. The technological "gee whiz" of some of the prostheses tends to reinforce this premise. Prostheses have lights, buzzers, bells, printers, TV attachments, and, most recently, voices. The prostheses *look* and *sound* complete in and of themselves, so it is perhaps easy to assume that once prostheses are provided to a child, a "complete" communication system is established. Unfortunately, this is not true. The prostheses are only one component of the communicative process, and their provision marks one of the early steps in helping children to develop communication skills.

It is important for practitioners to remember that they need to help the child achieve more than a functional mode for expression. Children also need to be able to use their prostheses in the process of interacting with other persons. Practitioners need to help children develop skills that will enable them to effectively *interact* with others and to have an effect on the environment. If program efforts cease once communication (or, the ability to transmit information) is achieved, the child still may be unable to fully participate in and interact with his/her environment. Children should be able to do more than formulate and express basic thoughts and desires. They should be able to participate in and have an impact on what is happening around them. Competence in this area means that the children not only know how to operate a communication prosthesis or answer questions and make simple statements with it but are also able to use the prosthesis for as many varied uses as they would use their voice (if oral speech were functional).

The steps involved in participating in communicative interaction processes and the potential barriers to the development of effective interaction and analysis of nonvocal communicative interactions are the focus of this article.

PROCESSES INVOLVED IN COMMUNICATIVE INTERACTION

It is important to examine the bare essentials of a communicative interaction between two persons. First, there is the setting and attitude or mood (either positive or negative) toward interaction. Assuming that the mood is positive, one person thinks of an idea or thought to express (an intention), formulates it, and

expresses it to the other. The other person receives the message and reacts to or acknowledges it in the same manner. From here on a series of turn taking occurs with topic and speaker shifting until the interaction ends. Throughout the interaction the communication of each speaker is effecting and influencing the thoughts and communication of the other. They are mutually participating and each person's role is clearly defined (e.g., either they are speaker or receiver). Other than frequent normally occurring and accepted pauses and hesitations, the conversation flows smoothly from beginning to end, at least for vocal persons.

The process differs for nonvocal persons in some important ways, beginning when the speaker thinks of something to say (intention) and formulates it as an expression that the receiver will understand. As can be seen in Figure 1, this process for the vocal person is relatively easy and is accomplished rapidly, even with all of the variables and choices that need to be made regarding semantics, syntax, pragmatics, phonology, listener skill, social environment, and so on. Whatever time and

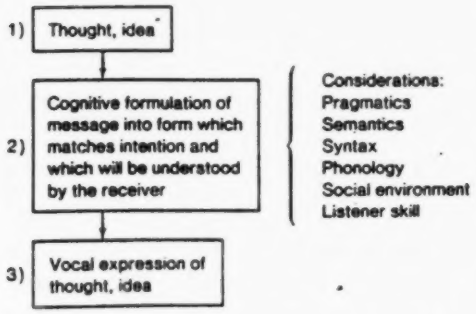

Fig. 1. Intention to expression for vocal speakers.

thought the speaker spends on the formulation of expression is primarily spent in the second step, the cognitive formulation. Little effort is spent on thinking about how one will physically express the message (e.g., what shape to put the mouth in to produce various sounds, etc.). Once the thought has reached Step 3 (see Figure 1), the expression is almost reflexive. The speaker is primarily concerned with assuring that the message is appropriately formulated and lets the receiver take it and the course of the conversation from there. Each speaker is responsible for their own formulation and expression of communicative intent.

This initial step in interacting with others is much more complex for nonvocal persons, who use augmentative communication prostheses, as can be seen in Figure 2. There are, at minimum, eight steps involved, in contrast to three for a vocal person. More steps are involved if as in Step 6 there is no direct vocabulary match or if as in Step 8 the message is incorrect and needs to be reformulated.

There are some other important differences that occur. A primary difference involves listener participation. In vocal interaction the listener basically listens and waits for his/her turn. In interactions involving nonvocal persons, however, the listener may need to assume an active role in the speaker's message formulation and expression. For example, at Steps 3 and 4, the nonvocal speaker may opt to express his/her message by using a manual scanning display. If so, message expression depends on the receiver pointing to message elements and assembling the message for the speaker. In such a case the receiver

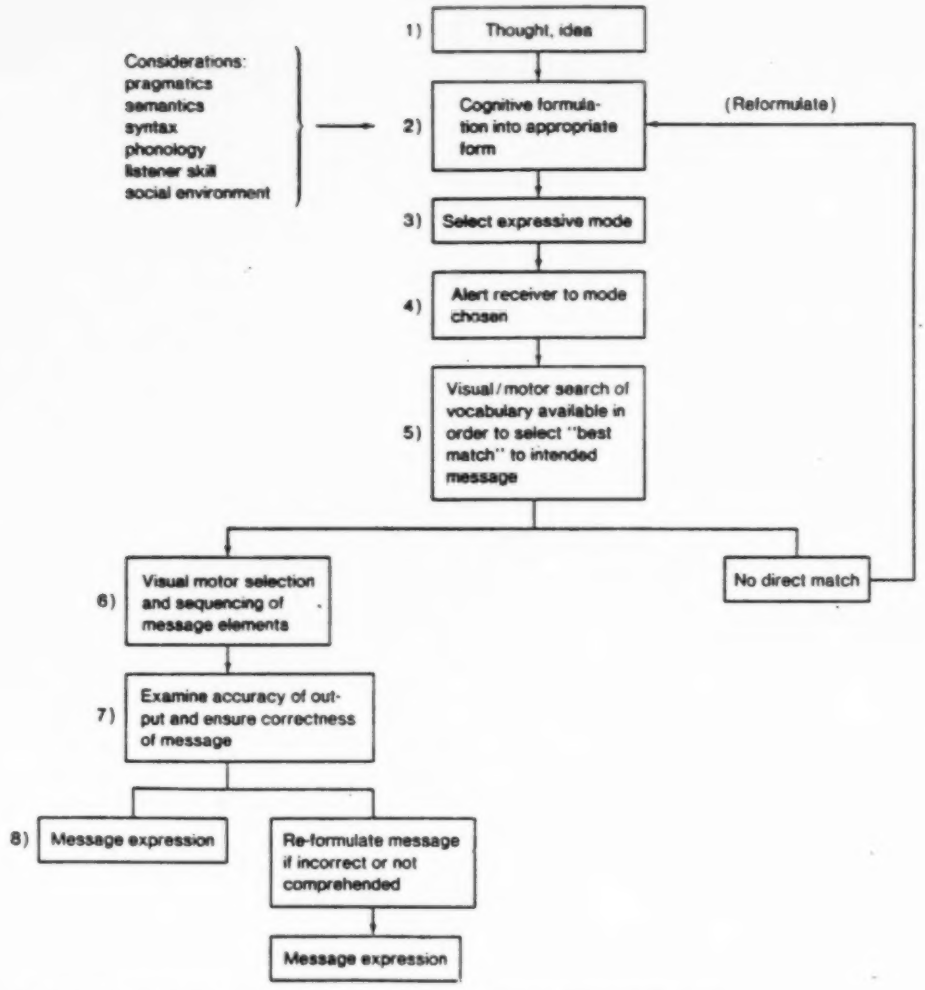
1) Thought, idea
Considerations:
pragmatics
semantics
syntax
phonology
listener skill
social environment
2) Cognitive formulation into appropriate form
(Reformulate)
3) Select expressive mode
4) Alert receiver to mode chosen
5) Visual/motor search of vocabulary available in order to select "best match" to intended message
6) Visual motor selection and sequencing of message elements
No direct match
7) Examine accuracy of output and ensure correctness of message
8) Message expression
Re-formulate message if incorrect or not comprehended
Message expression

Fig. 2. Intention to expression for the nonvocal person using an augmentative aid.

is actively listening *and* expressing at the same time. Whereas in the previous example speaker and listener roles are clearly defined, here they are not as straightforward. Thus, the traditional conversational turn-taking protocol is disrupted, and this can affect the speed, ease, and comfortableness with which conversation occurs.

Additional complications occur at Step 6, when the nonvocal speaker is selecting and sequencing message elements. Depending on the particular mode chosen, this process can be an active one (e.g., with direct selection devices) or a passive one (e.g., scanning devices). In the former, the speaker selects the elements; in the latter,

the prosthesis selects them while the speaker guides or directs. Also, the speaker needs to keep the whole message in mind while assembling it and ensuring accurate expressions of its parts. The speaker also needs to deal with possible interference by the receiver as he or she is formulating the message. If the receiver second guesses the speaker's message, the speaker must choose either to ignore the interruption or stop, acknowledge its accuracy, and proceed at the appropriate step. Or, the listener may change topics midstream, leaving the speaker in the middle of expressing a thought.

Overall, the process of intention to expression is much more complicated for nonvocal persons. It takes longer to accomplish and obscures traditionally defined speaker–listener roles. Even at this initial step of interaction the nonvocal speaker needs skills beyond those learned regarding how to use the communication aid. Knowledge and skill are also needed to influence and interact with listeners, select appropriate communication modes, formulate thoughts and express them via available vocabulary, selectively incorporate listener interruption, and check the accuracy and listener comprehension of the final message. If these skills are not learned, effective communication between the nonvocal person and others will be difficult to achieve. Other factors may also be involved in the failure of communication processes and may be thought of as potential barriers to effective communication.

The traditional roles of speaker and listener are not always clearly defined in interactions involving nonvocal persons.

POTENTIAL BARRIERS TO EFFECTIVE INTERACTION

Altered conversational patterns

The traditional roles of speaker and listener are not always clearly defined in interactions involving nonvocal persons. Hence, the pattern of turn-taking protocol is altered. This also affects the ability of speakers and listeners to initiate, maintain, and terminate topics. When traditional roles are reversed and listeners become active in message formulation and expression, the notion of reciprocal influence is altered. Instead of mutual participation, the interaction is dominated by the active person, the listener. These altered conversational patterns are not problems themselves as long as both speaker and listener are aware of the different roles that each will be assuming. However, these patterns maybe a critical barrier to interaction when the nonvocal person is communicating with strangers or persons who are not aware of the need to alter traditional conversational habit.

Augmentative devices and techniques

Although a critical component of interaction processes, augmentative devices and techniques can also pose barriers. The type of aid or technique chosen for use by the speaker will determine, to a great extent, the specific roles of the participants. For example, if a manual device or

technique is chosen, the listener may need to assume an active role in message formulation and expression. If an electronic prosthesis with printout is chosen, the listener may be able to assume a more traditional role. Although electronic devices with printout provide a more standard communicative interchange, they also may pose a potential barrier in that their use may take the "social" out of interaction. If, for example, a device has a visual graphic display or voice output, the listener may physically leave the speaker while the message is being composed and return to "read the output" or "hear the message." This gives the speaker time to formulate the expression but also leaves him/her without a listener. Motivation to use advanced prostheses may decline if their use means that listeners will disappear and return at their convenience. Prostheses and techniques that augment the child's vocal skill need to be evaluated and perceived both in terms of their ability to enhance the child's communication skill and in regard to their effect on conversational interaction.

Speed

The length of time needed to successfully formulate, transmit, relay, and acknowledge a thought is much longer in interactions involving nonvocal persons. As a result, listeners (and speakers) get frustrated and impatient. Listeners may fill in and second guess the speaker's intent and speakers may give up and tune out. This may affect not only the interaction at hand but the type, quality, and duration of interactions as well.

Laborious and tiring formulation and expression of messages

Message formulation and expression is a time- and energy-consuming task for the nonvocal speaker. The vocal person primarily concentrates on what he or she is going to communicate, how it will be received, and so on. The nonvocal person also concentrates as much or more time and energy on the physical task of expressing the message. This additional effort will influence both the quantity and quality of what is communicated.

Neglect of the speaker's repertoire of expressive modes

Nonvocal speakers usually have a number of options in terms of modes of expression available to them. Interaction can be adversely affected if the speaker is unable to choose a mode appropriate to both the situation and the listener's skill level (e.g., if he or she chooses to use a printout prosthesis with a listener who cannot read or chooses idiosyncratic gestures with a stranger). Equally detrimental to interaction is a listener's refusal to accept the mode chosen by the nonvocal speaker (e.g., "don't gesture, tell me with your word board"). Either of these patterns may result in a rapid termination of interaction.

Effect of symbol system used on conceptualization of experiences

Symbol systems can have an effect on the quality, quantity, and comprehensibility of messages expressed by the speaker. A primary influence is the total number of vocabulary items available to the speaker.

Unless the speaker can spell or utilize encoding schemes, only a finite number of vocabulary items are available.

The type and visibility of items available will influence both the topic and content of what is expressed. In addition, some symbol systems may influence the manner in which experiences are conceptualized and thus expressed. For example, a child using Bliss symbols may refer to spaghetti as "long food." A message receiver would need to be able to make a similar conceptualization for effective interaction to occur.

General experience, skill level, and motivation to communicate and interact

Also important is the speaker (or listener's) general experience and motivation to communicate and interact with others. If the nonvocal person approaches the interaction process with only the skills necessary to operate and use an augmentative prosthesis for expression, he or she may quickly become frustrated. Each unsuccessful interaction will influence that person's desire to participate in or initiate future interactions.

If nonvocal children are to be effective, active participants in their social and physical environments, they need to be provided with *more* than an augmentative communication prosthesis. They also need to acquire the skills necessary to (a) use that prosthesis efficiently as a mode of expression and (b) effectively utilize this and other modes of expression available to them in order to socially interact with and affect their environment.

Developing and providing communication prostheses to nonvocal children has consumed most of the research and clinical programming effort to date. Whether or not children use these prostheses to their fullest potential and in fact develop effective social interaction skill is a new and important research area. An exploratory study in this area has been conducted recently (Harris, 1978). This study examined nonvocal children's communication processes in classrooms and revealed a surprising discrepancy between potential and actual interactions.

COMMUNICATION INTERACTION PROCESSES IN CLASSROOM ENVIRONMENTS

To date, no research studies or clinical experiences have been documented which show that once a nonvocal child has been provided with an augmentative communication prosthesis (and has demonstrated skill in operating the prosthesis) the child will use the prosthesis to initiate and participate in communicative interactions with other persons.

In fact, observation of communicative interactions involving nonvocal severely, physically handicapped (NVSPH) children who use communication devices reveals that (a) message receivers often view and utilize the augmentative device as the NVSPH child's means of *responding* to (vs. interacting with) them, and (b) NVSPH individuals infrequently initiate communication and adopt passive roles in those communicative interactions that are initiated by others.

Although use of augmentative prostheses for *expressive* purposes is certainly

a benefit to the child, a primary goal in providing these prostheses is to help the child become an active participant in social *interactions*. Harris (1978) investigated communicative interactions between teachers and nonvocal children in public school classrooms.

Communicative interactions between three children and their teachers were observed in three major classroom contexts: free-time activity, individualized instruction, and small group instruction/discussion. The study documented interrelationships between three basic components of communicative interaction. These components were (a) *participants* (message senders and receivers), (b) *communicative modes* utilized, and (c) *communicative functions* expressed by participants.

These components were chosen to provide an analysis of (a) the extent of teacher–NVSPH child participation in communicative interaction within the classroom, (b) the channels or modes through which this communicative interaction occurred, and (c) the functions that communication served for both teachers and children within these contexts.

Research questions

The research questions that provided the framework for study were as follows: What is the extent of participation of NVSPH children and teachers in communicative events within the classroom? Specifically, (a) How often do NVSPH children and teachers initiate and respond within communicative interactions? (b) What is the length of turns taken (in terms of the number of "units" or utterances within a turn)? (c) What is the proportion of teachers versus NVSPH child turn initiations and turn responses within a given context? How (through what communicative channels or modes) do NVSPH children and teachers participate in classroom communicative events? What communicative functions are expressed by the teachers and NVSPH children via the channels or modes utilized?

The investigation included three target children (see Table 1). The children ranged in chronological age from 6 to 7 years. All were nonvocal and experienced severe motor handicaps as a result of cerebral palsy. They were nonambulatory and confined to wheelchairs, but the children were not mentally retarded. Prior to (and unrelated to) the study, each child had been provided with an Auto-com communication device and had demonstrated operational competence with this device.

Data were collected through direct observation and videotape recording of communicative interactions between teachers and children as they occurred during free time, individualized instruction, and small group instruction contexts in the classroom.

Free time contexts were those time periods during the school day that did not involve specific academic instruction or structured, teacher-directed discussion. Included were times during which the children were allowed to play and interact freely with peers, teachers, or other persons. The free time contexts observed for all children took place in the morning immediately after their arrival at school and before the beginning of the day.

Table 1. Subject description

Target subject	Chronological age	Date of birth	Data related to communication and cognitive skill	Educational environment
S_1*	7 yr, 5 mo	9/8/70	Miller Yoder (3/9/77): "Normal" Boehm (3/29/77): "Normal"	Self-contained special education class in a public elementary school. One teacher, one teacher aide, and 10 multihandicapped students.
S_2	6 yr, 5 mo	3/3/71	PPVT (3/30/77): CA = 6–1 MA = 6–6 Miller Yoder (3/77): "Normal" Boehm (1/77): "Normal"	Same as the above.
S_3	6 yr, 6 mo	7/5/71	Zimmerman Preschool Language Test (5/13/76): CA = 4–10 Aud. Comp.: Age 4–4 Miller Yoder (5/6/77): "Normal"	Regular first grade in a public elementary school; one teacher, one teacher aide, 25 children (S_3 was the only handicapped child).

* All subjects were nonvocal cerebral palsied, and utilized a wheelchair as their primary mode of mobility (with the exception of S_2, who primarily utilized a walker.)

Individualized instruction contexts were those periods during which the children were involved in a teacher-directed educational activity that included the teacher and the subject on a one-to-one basis, or the teacher, the subject, and a maximum of one other student (one-to-two basis).

Small group instruction contexts were those periods during which the children were involved in a structured educational activity that included at least themselves, the teacher, and three other students.

The videotaped observations were transcribed using a categorical coding scheme that was developed for this study. The model allowed coding and analysis of four levels of behavior related to communication interaction processes. These were conversational *turns* (i.e., teacher turns, child turns, and peer turns); *unit types* within a turn (i.e., teacher initiation units, teacher response units, child initiation units, and child response units); *communicative functions* expressed via turn units (instruction, description/statement, question, response, communicative "fill," and praise or reinforcement); and turn *forms* (vocalizations, gesture, eye point or head shake, and Auto-com used in a "manual" manner).

Communicative interactions were

coded using a decision-making strategy such as the following:

- Did a conversational turn occur?
- Who was the participant? (teacher or child)
- What type of turn unit was it? (initiation or response)
- What was the communicative form of the turn or, What communicative mode was utilized?
- What communicative function did the turn serve?

The conversational turn was used as the basic unit of analysis as one of the primary concerns of the study was the description of processes of communicative interaction between teachers and subjects. The organization and exchange of turns is fundamental to conversation and information exchange, and has been described by Bates and Johnson (1977) and others as the basic unit of conversation (Ervin-Tripp & Miller, 1977; Moerk, 1977; Sacks & Shegloff, 1974). *Initiations* and *responses* were the types of turn units selected for observation to allow analysis of how often children and teachers initiated interaction or responded to partners' initiations within communicative exchanges.

The organization and exchange of turns is fundamental to conversation and information exchange.

Communicative forms (or modes) analyzed included vocalizations, eye pointing/use of head shake, gestures or direct pointing, use of the Auto-com in a manual mode, use of the Auto-com in an electronic mode, or combined use of any of the above modes. These particular modes were selected based on prior observation of the repertoire of communicative modes available to and utilized by the teachers and children in the various classroom contexts.

Communicative functions coded and analyzed included instructions, descriptions or general statements, questions, responses, communicative fill, and praise or reinforcement. *Instructions*, descriptions/general statements, questions, and praise/reinforcement were selected for analysis, since these functions comprise a major portion of interaction between teachers and students in educational environments (Cazden, 1972; Cherry, 1977). *Responses* were selected as a function category, since prior observation revealed that this was a primary communication function expressed by NVSPH children in interactions with others. The category *communicative fill* was selected, since prior observation revealed that persons interacting with NVSPH children often filled their interaction with words, vocalizations, or sentences that were not intended as part of the conversation, but rather served as devices for filling silent periods that occurred while they were waiting for the child to respond.

As the reader will recall, the question to be answered here was, "What is the extent of participation of NVSPH children and teachers in communicative events and interaction processes within the classroom?

Results

Regarding the total *number* of turns taken within communicative exchanges,

teachers and children were found to be nearly equally contributory. However, regarding *length* of turns taken (in terms of units expressed per turn), teachers were found to contribute more than the children in all contexts observed. Of special note is that the children never expressed more than one unit per turn taken (e.g., their interaction consisted primarily of one-word responses). Children and teachers were most interactive (in terms of total numbers of communicative exchanges) in individualized instruction.

Question-asking interactions

Not all of the teachers' initiations required or expected a response from the child. This was especially true for instructions or questions. These types of initiations usually require a response on the part of the message receiver, but teachers often presented a whole series of instructions or questions to the children. Only one initiation within the series was expected to be responded to, whereas the others were expressed either to fill a silence gap while the child responded or to provide prompts for answers. The additional questions were not necessarily intended as part of the message exchange.

Example

T: **What did you do last night?**
C: **(Begins to formulate a response using a communication board.)**
T: **Did you go home?**
T: **Did you watch TV?**
T: **Did you see Walt Disney?**
T: **Did your brother come home?**

This type of interaction was noted primarily in those contexts in which the teacher and child were interacting on a one-to-one basis. Occurrence of this type of interaction helps to explain why, even though more exchanges occurred in one-to-one contexts, children and teachers contributed more equally to interactions in the small group context. In the latter context, teachers did not feel as pressured to fill the gaps, since interactions with other students could be going on during waiting periods. Thus, they initiated less and there were fewer total number of exchanges.

Two basic types of conversational interactions were noted between teachers and children. In one type, a teacher would ask a question and wait for the child to respond. The teacher would be silent during the wait. Alternately, a teacher would ask a question and fill the silence gap with a series of questions or statements as noted previously. The former type of interaction fostered statement interactions on the part of the children, whereas the latter type fostered yes or no one-word responses. Thus, increasing the length of time allowed to children in their formulation of messages appeared to result in expression of messages more complex than one-word yes or no responses.

In general, it was observed that communicative interactions with the children usually were initiated with a specific purpose in mind (e.g., to ask a question related to physical care of the child, to ask educational questions, to instruct them to do something, etc.). People rarely interacted with the children unless they were in search of specific information or unless the child initiated an interaction. General interest conversations, passing the time of day, and exchange of humor or anecdotes

rarely occurred. A general atmosphere seemed to be created in which communicative interaction was gotten over with as soon as possible. Conversational techniques often used to maintain interaction were absent, and children were rarely allowed time to express more than one-unit responses. This was especially true if formulation and expression of the message was physically difficult and time consuming. These interaction processes fostered an atmosphere in which nonvocal children rarely initiated communicative interaction.

In summary, analysis of *participation in communicative exchanges* revealed the following: (a) Communicative interactions in all contexts were dominated by teachers, who contributed a greater number of turns to communicative exchanges, and substantially more information per turn than the children. (b) Teachers primarily initiated in their interactions; children primarily responded. (c) Childrens' interactions consisted exclusively of one-unit turns; thus, their interactions were primarily one-word responses. (d) Children rarely interacted with peers or other persons besides teachers in any of the contexts.

These observations contrast with those documented in studies of communicative interactions of vocal children.

Data described by Pinnell (1975) and Dore (1977) indicates that vocal, ambulatory children of the same chronological age as the target children present a substantially different profile of participation in communicative interactions. Children documented in the literature were observed to be more interactive overall and primarily interacted with peers. Their interactions primarily consisted of propositional structures including the subject and predicate. The children in this study were not as active overall, they rarely interacted with peers, and their interactions were primarily one-word responses to teachers' instructions and questions.

Differences in the profiles presented by the vocal children in the literature and the children in the study may be attributed to a number of factors. In this investigation, teachers primarily dominated interactions by (a) initiating more often and (b) maintaining the flow of interaction as a result of their adoption of the role of message translator as well as message receiver. When interacting with the children through all modes (except for the Autocom), teachers had primary responsibility for the formulation and expression of messages exchanged (e.g., when the child gestured or pointed, the teacher had to express, interpret, translate, and confirm the child's message, as well as formulate and express her own). Communicative exchanges thus occurred, with the child providing minimal cues and the teacher bearing the responsibility of interpreting those cues and developing the conversational exchange. This type of interaction strategy results in teacher- or message-receiver dominance of communicative exchanges and passive participation on the part of the child (even for child-initiated exchanges).

It was also found that children rarely interacted with their peers. This may have been the result of discrepant communication skills between the child and his/her peers or a result of the childrens primary reliance on communicating with adults.

It was noted that the children primarily

interacted with adults, providing more experience communicating with adults than with peers. Primary communication with adults may be the result of childrens' dependence on adults for physical and daily living skills, the amount of time children spend with adults in one-to-one teaching and therapy settings, or their need for a skilled message receiver who could formulate and develop the conversational exchange.

The extent of participation in any communicative exchange by nonvocal children was often related to communicative modes utilized.

Communicative modes

Teachers and children primarily used those communicative modes that were most accessible to them, required the least amount of physical effort, resulted in the fastest message transmission, and with which they were most comfortable (e.g., had a history of using and have developed acceptance on the part of message receivers). When initiating communication, children primarily used those modes that created the greatest visual or auditory attraction (e.g., gestures/pointing and pairing these with vocalizations).

Although it might be expected that NVSPH children would communicate through the most unambiguous mode (e.g., the one that would most clearly and accurately express their intention), children used those communication modes that were faster but were more likely to create ambiguous messages. This may occur for a variety of reasons: The children may enjoy the process of having message receivers interpret their ambiguous messages and may be utilizing this as a strategy for the maintenance of interaction; children may be taking advantage of placing the burden of communication on the part of the message receiver (a particularly convenient strategy in educational contexts when children are asked to contribute information which they may be unsure of), or children may primarily rely on idiosyncratic and ambiguous modes of communication at home and continue this reliance in the educational setting.

Frequently, communicative modes were inappropriately used (e.g., children were obligated or forced to use one particular mode or a mode was not utilized efficiently).

For example, teachers would ask a question, and a child would correctly and unambiguously answer through one of the modes available to him/her. Rather than accept the answer and continue the interaction, the teacher would refuse the answer and specify that the child use a different mode for expression:

T: What do you want?
S: [Points to the ball.]
T: No, tell me with your board.
S: [Points to the ball again.]
T: How can you tell me with your board?
S: [Puts head down on laptray and does not respond.]

This type of exchange resulted in children's refusal to participate further in the interaction and a decline in the use of both

The Auto-com is most effectively utilized as a fast, efficient communication mode in group situations.

the mode initially offered and the mode requested. The latter example (in which communication mode was not utilized efficiently) primarily involved use of the Auto-com. As designed, the Auto-com is most effectively utilized as a fast, efficient communication mode in group situations. Here, a statement/question can be addressed to the user, and although the user formulates his/her message, interaction with other group members can continue. In this study, the Auto-com was most frequently utilized in one-to-one interactions (where it had no particular advantage over other modes) and was not frequently utilized in group situations (where it could substantially improve the speed and efficiency of communication).

Analysis of participants use of communicative modes revealed the following:

- Teachers primarily used vocalizations or vocalizations paired with gestures/pointing to a chalkboard or textbook for their communicative interactions in all contexts observed.
- Ranked in overall frequency of use, children used (a) head shakes, (b) gestures/pointing, (c) combination of modes, (d) Auto-com (electronic), (e) Auto-com (manual), and (f) vocalizations. (This rank order pertained to all contexts except one to one, in which the electronic Auto-com was used with second greatest frequency.)
- Children primarily combined vocalizations with head shakes or gestures/pointing; vocalizations or other modes were never combined with use of the Auto-com.
- Children rarely utilized vocalizations alone.
- Modes used by the children when *initiating* communication were (in rank order according to preference) (a) gestures/pointing, (b) combinations of modes, (c) Auto-com (electronic), (d) vocalizations, (e) head shakes, and (f) Auto-com (manual).

Communicative functions

As you will recall, we were also interested in the communicative *functions* that are expressed by the teachers and NVSPH children via the communicative modes utilized. It was found that teachers' expressions were primarily instructions, general descriptions/statements, or questions. They infrequently expressed praise/reinforcement.

Children almost exclusively expressed responses to teachers' instructions or questions.

A primary reason for these results may relate to factors mentioned earlier regarding participation in communicative exchanges. The functions of the messages recorded in this study were often interpreted by the message receiver, and the child needed only to confirm or deny the match between his/her intended message and the message interpreted and expressed by the message receiver. For example:

S: [Gestures and points to the door and vocalizes.]
T: You want to go out?
S: [Nods head "yes."]
T: [Takes child out.]

Here, the expression and function of the message was provided by the teacher and confirmed via a one-unit response by the child.

When communication is initiated primarily to accomplish specific purposes (as opposed to information exchange in general), the functions of children's communication may be limited to that called for by the message initiator. In the contexts observed, this primarily meant responses on the part of the children. Children were not often afforded the opportunity to express other functions such as questions, since most of their needs were provided for or second guessed.

Speed of communication is also a factor. Responding to instructions or questions can be accomplished quickly and unambiguously through motor responses (pointing to locations, objects, etc.), head shakes, or saying yes or no. Expression of other communicative functions takes more time and effort for both the child and the message receiver. Time-consuming translation exchanges may discourage the child from expressing messages and functions other than those that he or she is assured will be understood with relative ease by the message receiver.

IMPLICATIONS OF THE RESEARCH STUDY FOR COMMUNICATION PROGRAMS

Results of this study imply that a reorientation toward strategies for interacting with nonvocal children needs to be developed. If nonvocal children are to initiate and maintain communicative exchanges with other persons, they need to develop skill with communicative modes that will allow them to become more active participants in the formulation and expression of messages. Use of communication modes that allow (and obligate) the child to independently formulate his/her own message should be developed and encouraged. When the child has a choice of communicating messages through various modes, use of the mode that places primary responsibility for the formulation of the message on the child should be encouraged. Use of any one particular communication mode should not be forced, however. All modes available to the child should be used and accepted, but the least ambiguous mode should be encouraged.

Responsibility for and participation in communicative exchanges should be mutually shared by message sender and receiver. Results indicate here that when not mutually shared, the communicative exchange becomes dominated by one of the participants (the teacher) and results in limited, passive participation by the other (the child). Providing the child with communicative modes that allow more active participation, developing the abilities to utilize these modes effectively, and *allowing and expecting him/her to communicate via these modes* and become actively involved in communicative interactions is important. This should result in (a) increased communicative initiations on the part of the child, (b) reduced teacher dominance of interaction sequences, (c) more complex messages exchanged by the child, and (d) an increase in the number and type of communicative functions expressed by the child.

To accomplish this message, receivers should relinquish dominance of interactions and second guessing the child's intended message form and function and provide the child with sufficient time in which to formulate and express the mes-

sage. Related to the latter, message receivers should also develop a tolerance for extended periods of silence while waiting for a child to formulate the message, and refrain from providing excessive and potentially confusing input.

To enhance peer interaction, children should be placed in educational environments with peers who share common communicative systems, similar experiences, and similar cognitive and communication skill. Teachers should ensure that NVSPII children and their peers can see and hear messages that are exchanged.

In addition, message receivers should interact with nonvocal children for enjoyment purposes as well as to obtain answers to educational or physical need-related questions. Children should be encouraged to initiate communication and express their thoughts, ideas and questions, opinions, and humor in a variety of ways. Children should be provided with opportunities to interact in ways beyond one-word responses and skills needed to express messages via different forms and functions. In addition, they should be *expected* to contribute to interaction.

To be most effective, augmentative communication prostheses need to be accessible to the child in all situations and environments. They should require the least amount of physical effort on the part of both message receiver and sender and the least amount of time possible for both the formulation and expression of the message. In addition, they should allow and enhance peer interaction and allow the child to independently formulate and express the message in an unambiguous manner. Children should be provided with a repertoire of communication modes that are accepted by both peers and adults. Strategies for selecting and using the most effective mode with various message receivers should be taught to the child. Equally as important, strategies for participating in communicative interactions via these modes should be explained to message receivers.

It would be anticipated that more diverse use and expression of communicative functions would be observed as message receivers relinquish control of communicative interactions. Finally those communicative modes should be selected that will enhance the expression of diverse communicative functions.

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The process of developing effective social interaction skill is complex. For nonvocal children, the process is painstaking. Augmentative communication devices can help to make the process easier and more rewarding, but they cannot do the interacting for the child. They can be the child's *mode* of expression or communication and thus a critical component of the process, but the prostheses do not comprise communication systems in and of themselves.

The success of the device or of the child as an interactive person will depend on his/her ability to learn and to use a variety of skills. Some of the skills relate to operational use of the device, to expression of various messages and communicative functions, and to perception of the needs and skills of message receivers.

This article has discussed steps involved in communicative interaction processes

and potential barriers to effective interaction for nonvocal persons. Interactive processes have been presented as communication systems, systems of which expressive skill or use of an augmentative prosthesis are just a part. The research study presented examined some basic interaction processes as they occur with children who are using augmentative devices. Discrepancies between processes that *could* be occurring and those that are occurring were noted. These discrepancies indicate that communication programming needs to become more comprehensive. Teaching children needed skills for expressing themselves with communication devices is an important component of education but should not comprise the entire program. Adopting *effective interaction* as a program goal will help practitioners and parents to remember that expressive skills and augmentative devices (no matter how fancy) are only two components of a complex process.

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